THE REMOVAL OF GALL STONES FROM THE SECOND AND THIRD PORTIONS OF THE COMMON BILE DUCT.*

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THE removal of calculi from the gall-bladder was a recognized surgical procedure, when the removal of stones from the common duct was thought to be beyond the limits of the surgical art.

Surgical invasion of the common duct was at the beginning confined to the supra-duodenal, or first division. Stones in the other portions of the common duct, or in the hepatic ducts, which could not be forced into the first portion were not removed.

With the development of common duct surgery the terminal portions of the duct were invaded, through the duodenum by McBurney[1] and by Kocher;[2] and by the retroduodenal route, after mobilization of the duodenum, by Haasler[3] and others.

The main hepatic ducts were next incised and even their finer ramifications have recently been successfully relieved of calculi (Hepatico-hepaticotomy, 1906, Hawkes[4]).

At the present writing it may be said that concretions have been and may be safely removed from any part of the biliary apparatus.

The common bile duct is a tube approximately 3 inches (7.5 cm.) in length, extending from the junction of the cystic and hepatic ducts, downward, and to the left to unite with the canal of Wirsung and terminates in the wall of the second portion of the duodenum, about 3½ to 4 inches from the pylorus.

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It is divided into three portions: 1st, 2nd, and 3rd. (1) The supra-duodenal extends from its origin to the posterior surface of the duodenum where it comes in contact with the pancreas. This portion is from an inch to an inch and one half in length, approximately half of the length of the entire duct—about 5.8 mm. in diameter. With the hepatic artery, some lymph glands, and the portal vein it lies in the free border of the gastro-hepatic omentum, which forms the anterior boundary of the foramen of Winslow. (2) The retro-duodenal or pancreatic portion is about an inch, or an inch and one quarter in length and lies behind the duodenum, either in a groove on the pancreas or is completely surrounded by pancreas. (3) The interstitial, or transduodenal portion is about one-half to three-quarters of an inch in length and passes obliquely through the inner and posterior wall of the second portion of the duodenum. Its terminal portion is usually dilated, the so-called diverticulum of Vater, into which opens the duct of the pancreas, the duct of Wirsung. This diverticulum may be absent but is present in about nine out of every ten cases. When present its average dimensions are: length 6 to 7 mm., and its diameter 4 to 5 mm. The duct opens upon the duodenal mucosa by a small opening, about 2.5 mm. in diameter, the narrowest part of the common duct.

The orifice is in a papilla; this papilla may often be found by noting a longitudinal fold of the mucous membrane, which is continuous with the papilla and is conspicuous among the transverse valvulæ conniventes. It may better be located by the sense of touch, as it feels like a small round shot in the mucosa.

Ascending infection is, in a way, prevented by the oblique insertion through the muscular wall of the duodenum, and the presence of a sphincter muscle, the so-called sphincter of Oddi, which is an augmentation of the circular muscle coats of the duct.

Common duct obstruction is usually due to either malignant disease, or to calculi, which may be either biliary or pancreatic. Congenital stenosis has occurred.

The signs and symptoms are, as a rule, characteristic and consist of repeated attacks of colic, nausea and vomiting, high temperature, constant icterus gradually increasing after each attack, acholic stools. Between attacks, which may occur with marked regularity, most of the symptoms disappear, with the exception of the icterus and a tenderness in the epigastrium. There is a gradual loss of weight and no enlargement of the gall-bladder.

The differentiation between a stone and carcinoma may be made after a review of the history, and observation of the condition of the gall-bladder. Courvoisier's law has been found to hold true in about 80 per cent. of cases, and is as follows: dilated gall-bladder occurs with malignant obstruction of the common duct, while a contracted gall-bladder will be found if the obstruction is due to cholelithiasis. The coincidence of calculi and malignant disease may give rise to confusion. Gall-stones are a most frequent cause of cancer of the gall-bladder, but not so of the gall-ducts. In 22 cases of carcinoma of the papilla, collected by Edes,[5] gall-stones were found only 4 times, and in 3 of these the stones were in the gall-bladder and only one in the common duct.

A differential diagnosis between biliary and pancreatic calculus as a rule, is not made, though Moynihan[6] has made a correct diagnosis of pancreatic calculus. The diagnosis is made chiefly upon the following points:

Colic less severe than biliary colic, diabetes, fatty stools, an absence or late appearance of jaundice, the passage of fragments of pancreatic calculi.

A differential diagnosis as to what particular portion of the common duct is obstructed is neither practical nor essential; a diagnosis of common duct obstruction by stone demands laparotomy and removal of the obstruction providing that the patient is in condition for the operation.

The treatment of stone in the common duct is surgical and consists of removal of the stone. Enlarged lymphatic glands may cause confusion in diagnosis as may disease of the pancreas, or malignant disease of the diverticulum of Vater.

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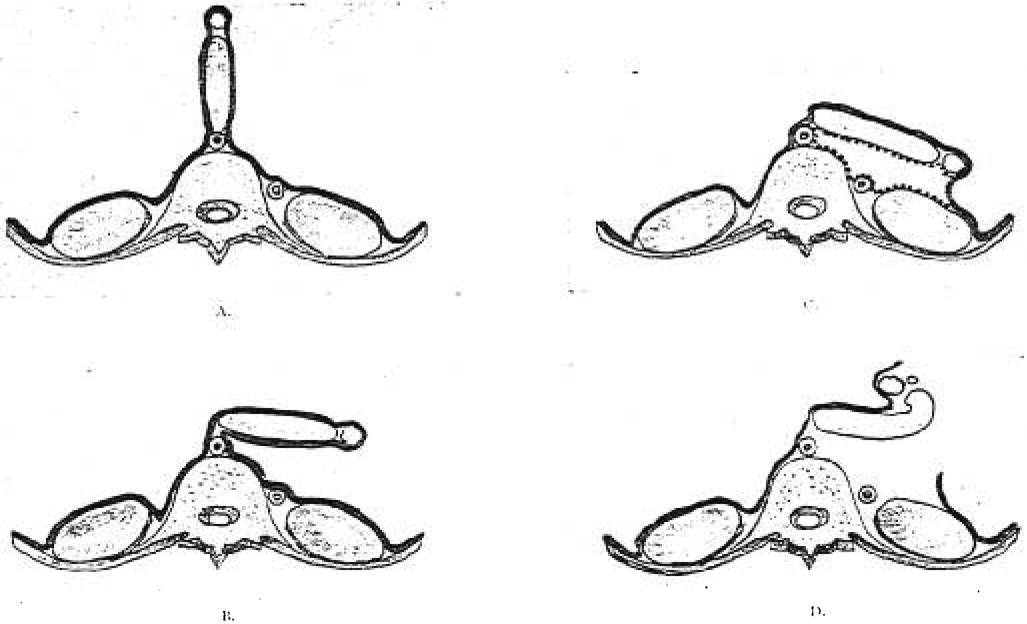


A, B, C, (from Huntington). Diagrammatic representation of three stages in the development of the mesoduodenum, duodenum, and pancreas leading to the secondary "retro-peritoneal" position of these viscera. D. Showing the principle of the "mobilization" of the duodenum, which brings its posterior surface and the common duct into the operative field.

Even W. J. Mayo[7] mistook a carcinoma of the duct for a stone until it was exposed by incision of the duodenum, and Fenger[8] did cholecystenterostomy for what was thought to be a carcinoma of the pancreas; only, at autopsy, to find a stone in the ampulla of Vater. Similar errors have been recorded by others.

Concretions in the second and third portions of the common duct frequently escape detection, and they are especially prone to be overlooked in cases in which stones are found in the first portion. Careful palpation of the second portion of the duodenum should always be carried out in all cases of common duct stones. If the lowermost stone removed from common duct is faceted at its distal end another stone should always be looked for.

Kuster,[9] Fenger,[9] Terrier,[9] Lauenstein,[10] Riedel,[9] Haasler,[3] Kocher,[10] Zeller[11] and others, report cases in which calculi in the diverticulum of Vater have been overlooked at operation. In the list of reported cases of transduodenal choledochotomy, many have been operated upon previously with the removal of stones from the gall-bladder or common duct. If a calculus is found in the lower portion of the common duct a judicious attempt should be made to force it back into the supra-duodenal portion where it may be removed by simple choledochotomy.

This will usually be possible. In over 2000 operations upon the gall-bladder or ducts the Mayos[12] have had to perform the transduodenal operation for the removal of stone in only 4 instances. In 100 cases recently reported by Kocher and Matte[10] they found it necessary in only 2 cases to approach the duct through the duodenum. Ochsner[13] in his experience has performed this operation twice and Murphy[14] not at all. This shows the infrequency with which impaction of the stone in the lower common duct occurs.

With a failure to force an impacted stone back into the first portion of the common duct, an effort may be made to pass the stone out of the duct into the duodenum. This is rarely accomplished: Haasler[3] reports such an instance and Robson[15] mentions a case in which the stone passed into the intestine during the manipulations of the operation, and was removed from the bowel by enterotomy. A similar case is mentioned by Pozzi.[16]

An impacted stone in the lower portion of the common duct that resists reasonable effort to dislodge it, must be removed by either retro- or trans-duodenal choledochotomy. Attempts to crush or needle the stone are blind and unsatisfactory; lumbar choledochotomy is no longer employed. Cholecystenterostomy or cholecystostomy are merely palliative procedures as they do not remove the stone. Instances may be met with in which the condition of the patient will not allow of any prolonged operative manipulations, and it may then be advisable to establish a provisional or temporary drainage by cholecystostomy, and the obstructing stone may be removed at a subsequent sitting.

RETRO-DUODENAL CHOLEDOCHOTOMY.

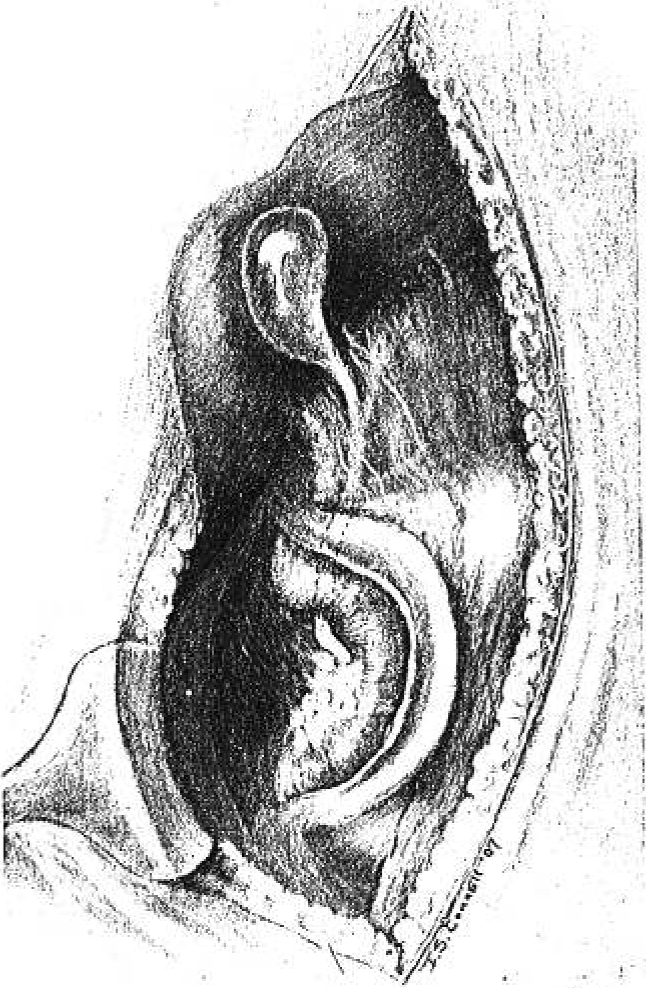
Retro-duodenal choledochotomy consists of an incision into the second portion of the common duct without opening into the duodenum. In order to accomplish this it is necessary to reflect the duodenum toward the median line, to mobilize the second portion of the duodenum as is done in Kocher's[17] gastro-duodenostomy.

This mobilization of the duodenum is a partial reproduction of the condition during embryonal life when the alimentary canal was a straight tube and the duodenum was supplied with a mesentery. The gradual changes from embryonic to mature conditions, with the loss of mesentery, by a blending of the right meso-duodenum and the primitive parietal peritoneum, after rotation of the first part of the small intestine, is well shown in the diagrams of Huntington.[18] (Fig. 1 A, B and C.)

In D, which we have added to Huntington's plate, a common duct has been inserted and the principle of the mobilization of the mature duodenum is shown.

The technique consists of an incision through the posterior parietal peritoneum about an inch to the right of the descending duodenum. The posterior parietal peritoneum and the

FIG. 2.



Exposure of the common duct for retroduodenal choledochotomy.

duodenum are separated from the retro-peritoneal structures to which they are attached; *i.e.*, areolar tissue. This dissection is best made with fingers covered with gauze. In normal structures no difficulty will be encountered, the bowel will be separated easily and as the blood supply enters mainly at the concavity of the duodenum, the hemorrhage will not be excessive.

After freeing the viscus from the posterior attachments, the rotation is made toward the median line with the hepatico duodenal ligament as a fixed point above, and the left border of the duodenum over the head of the pancreas, as an axis, which brings the posterior surface of the duodenum with the common bile duct and the head of the pancreas into the field of operation (Fig. 2).

Operations in which it is proposed to gain access to the second portion of the common duct by this rotation of the duodenum, have been advocated by Oscar Block,[10] Lane,[20] Vautrin,[21] Haasler,[3] Berg,[22] and Cooper.[23]

In certain cases this operation is quite possible and even practicable, and has been performed successfully many times, but with the coincidence of acute or chronic inflammatory conditions or neoplasms of the head of the pancreas, gall-bladder or ducts, stomach or liver, it may be impracticable or even impossible. Even where these conditions do not exist, the fact that the pancreas completely surrounds the common duct in two out of three cases, necessitating a division of the pancreas, is a point against the employment of this manœuvre.

As Binnie[24] well says: "These operations seem better suited to the dissecting, than to the operating room."

TRANS-DUODENAL CHOLEDOCHOTOMY.

The trans-duodenal method consists of an exposure of the common duct by means of an incision through the anterior wall of the duodenum. One of the objections to this mode of approach is, that there is greater danger of peritoneal infection because of the opening of the lumen of the bowel. But with increased experience and with improved technique, the fear of opening into the intestine is rapidly disappearing.

Theoretically there is but little difference, as regards infection, between a direct opening into the lumen of the bowel by a duodenal incision, or an indirect communication with the bowel lumen by means of an incision into the second portion of the common duct, which is directly continuous with the lumen of the gut, and in such a pathological condition that Nature's mechanism to prevent ascending infection is not effectual.

Retro-duodenal incision of the third portion of the common duct, of course, would be practically an opening into the lumen of the duodenum, and the location of the opening is by no means as well suited for proper and secure closure as is the anteriorly placed incision.

A distinction as to whether an impacted stone is in the second or third portion of the common duct cannot always be made.

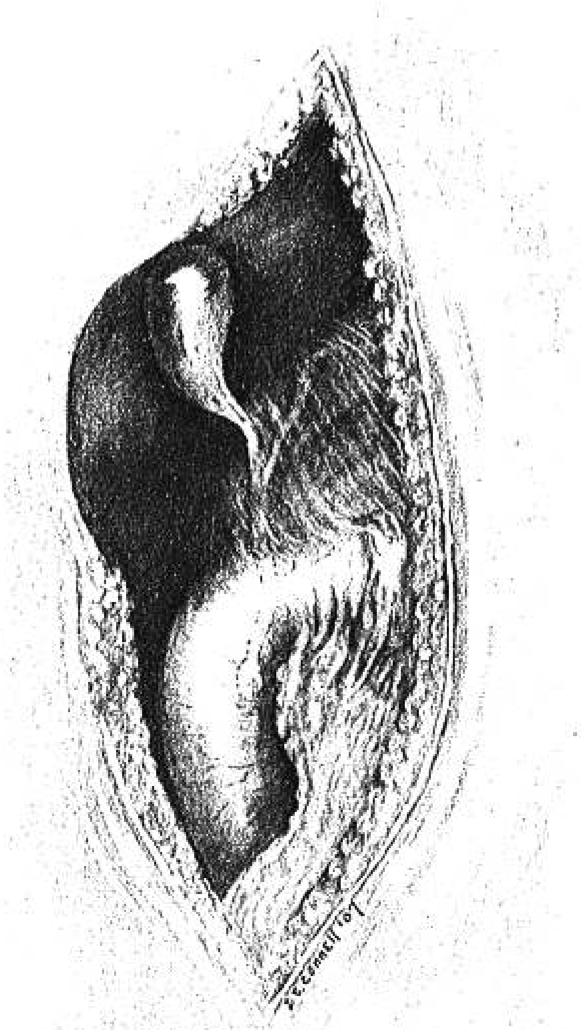
The duodenum is frequently incised for other pathological conditions, and other portions of the gastro-intestinal tract are incised daily without any great fear of infection. But of all portions of the bowel, it would seem from the experiments of Cushing,[25] that there is less danger of infections in operating upon the duodenum than on any other portion of the entire intestinal canal, as a preliminary starvation may render this part practically sterile.

Another objection to the trans-duodenal method is that of a possible duodenal fistula with death from inanition, which has been emphasized by Berg,[22] who states that such a complication frequently occurs and is due, not to defective suturing as much as to a pathological condition of the duodenal wall, in that adhesions may deprive it of its serous covering.

With secure and proper suturing, followed by rational after-treatment, the occurrence of fistula should be no more frequent in this location than it is after incision in other portions of the bowel. The position of the drainage and its relation to the suture line is all important. The drainage, if used at all, should be placed adjacent to, but not in contact with, the line of suturing.

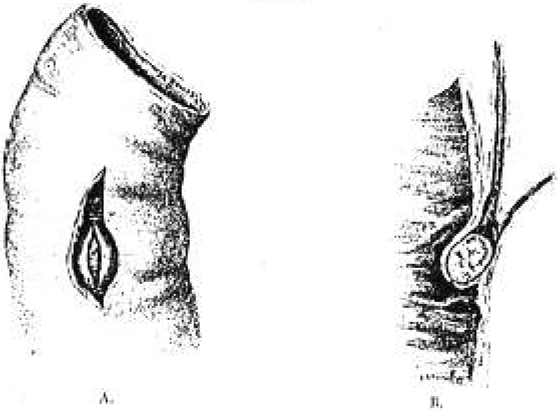
The technique of the operation itself, is as follows: A

FIG. 3



Shows entrance of common duct at the posterior internal portion of the second division of the duodenum.

FIG. 4.



A.—Incision of anterior duodenal wall, and mucosa of posterior duodenal wall, with exposure of stone in the diverticulum of Vater.

B.—Longitudinal section of common duct and duodenum showing stone in diverticulum of Vater.

sand bag is placed under the back at about the level of the liver. The head of the table is raised about 6 inches. The Mayo Robson [15] or the Bevan [20] incision is made. A preliminary exploration of the gall-bladder and adjacent structures is made. Gauze packs are inserted in the right kidney pouch and between the stomach and the ducts. Adhesions are separated and the foramen of Winslow opened. Rotation of the liver will be of great aid, if operation upon the first portion of the common duct is necessary. This manœuvre may tear the liver substance but such tears may be easily sutured with catgut and blunt needle.

As a rule it is not convenient to apply clamps to prevent the escape of intestinal contents, and this is generally unnecessary, as after proper preliminary treatment the duodenum will be empty. The stone and overlying structures may be grasped between a finger in the foramen of Winslow and the thumb over the duodenum.

The intestinal incision is made in the second portion of the duodenum parallel to its long axis (Fig. 3).

After exposure of the common duct through the anterior duodenal incision, the stone will usually be seen as an elevation or bulging beneath the mucosa of the posterior wall. The papilla, the opening of the common duct, may be visible below the stone, at the upper extremity of a longitudinal fold in the mucosa, conspicuous among the transverse valvulæ conniventes.

The calculus may now be removed in one of three ways according to its size and location. If in the diverticulum of Vater (third portion of the common duct), and is not too large, it may be removed by the method of Collins; [27] *i.e.*, dilatation of the opening with forceps, and delivery of the stone through the dilated, but not incised, opening of the duct. If in the same location, but too large to be removed through the termination of the duct, the McBurney [1] operation must be performed.

The papilla may be incised or the mucous membrane between the stone and the lumen of the duodenum, directly over the stone, may be incised sufficiently to remove the calculus (Fig. 4 A and B).

The method of Collins is preferable, but is rarely possible because of the size of the stone, or the pathological condition of the termination of the duct, which will not permit of any considerable dilatation.

Sutton[28] says that he has never found a stone larger than a cherry stone in the ampulla. Moynihan[20] says stones in this location are usually the size of a split pea. In the case reported with this contribution to the subject the stone was the size of a hickory nut. Robson[30] reports a case in which a stone the size of a pigeon's egg was removed from the diverticulum of Vater.

When the stone is impacted in the second portion of the common duct, the transduodenal operation will be that of Kocher.[2] To remove a stone from this portion of the duct, the entire posterior duodenal wall will be incised, and in addition, the anterior wall of the common duct.

After the removal of the stone it will be necessary to suture the anterior wall of the common duct to the posterior duodenal wall, thus forming an anastomosis between the second portion of the common duct and the duodenum (choledochoduodenostomia internia), in order to direct the bile into the intestine and prevent its escape into the retro-peritoneal space. Undoubtedly, adhesions will often be found between these two surfaces, thus doing away with the necessity of suturing.

The remainder of the operation is similar, in all; and consists of a thorough search for other stones. They may easily escape detection; digital palpation with ungloved finger is to be recommended. Kehr,[31] Mayo[32] and others, advocate the performance of a supra-duodenal choledochotomy and the carrying of a sponge through the second and third portions of the duct; in at the supra-duodenal opening and out through the duodenum (choledochusfege, Kehr). In this way one may rest assured that all the stones will be removed. The hepatic and cystic ducts and the gall-bladder are to be explored very carefully.

The incision in the anterior duodenal wall is now closed according to a recognized method of suture, care being taken to have a secure union. The suture line may be made transverse to the line of incision (duodenoplasty), if stenosis is feared.

The next question is as to drainage: drainage is always indicated. The nature of the operation itself establishes good drainage into the duodenum, but this is not considered as sufficient, therefore, a cholecystostomy is added, or, if the gall-bladder is so contracted as to not be available, as is sometimes the case with common duct stones, then drainage may be established by choledochostomy. Either the one or the other is essential.

SYNOPSIS OF CASE.—*Biliary colic and icterus one year ago. Second attack three months ago, accompanied by symptoms of perforative peritonitis. Recovery: One week after attack, a gall-stone was passed per rectum, since then characteristic symptoms of common duct obstruction.*

Operation.—Gall-bladder contracted with thickened walls; numerous adhesions, and enlarged lymph glands along the common duct. Mass in posterior walls of second portion of duodenum, evidently in the diverticulum of Vater. Attempts to mobilize the duodenum for the purpose of doing retro-duodenal choledochotomy abandoned because of adhesions and hemorrhage. McBurney's transduodenal choledochotomy performed, with removal of calculus. Exploration of common duct negative.

Incision in anterior wall of duodenum closed. Cholecystostomy for drainage. Closure of abdomen. Recovery.

History.—Female, age 26 years, housewife, American.

Family History.—Father has gall-stones, otherwise negative.

Previous History.—No illness or accident; has lived out of doors a great deal; is an enthusiastic equestrienne; menstrual history negative. Has been married 7 years and is the mother of 2 children, both labors and puerperia normal. With the exception of an attack of gall-stone colic one year ago, which confined her to bed but a few days, the previous history is negative.

Present Illness.—Begins July 27, 1906, with an attack of hepatic colic, in which she was attended by Dr. Geo. E. Newell of Buena Vista, Colo.

After the administration of morphia, followed by laxatives and enemata, she was better until the night of July 28th, when she had another severe colic with vomiting, a chill, temperature 104 F., pulse 140 and amaurosis followed by a stuporous condition. Jaundice was present but not marked. I first saw the patient with Dr. Newell at about midnight, six hours after the onset of the attack, when she was in better condition; complained of no pain, temperature 100, pulse 130; there was rigidity of the abdominal muscles of the right side, tympanites and tenderness on pressure over the region of the gall-bladder; she was still in a semi-stupor.

Immediate removal to the hospital was advised, but was not consented to. She remained about the same, with a gradual improvement in her mental condition and amaurosis, until the next night, July 29th, when she had another attack of pain with chill, temperature 105, pulse 150; complained of blindness and again fell into a semi-comatose condition. Tympanites, tenderness and rigidity were marked. Her bowels had moved by the aid of enemata, urine was normal with the exception of the presence of bile. This condition lasted about six hours, and preparations were being made for her removal to the hospital when she suddenly improved, and within 12 hours from the beginning of this attack her pulse and temperature were normal, consequently she did not enter hospital at this time. Gradually improvement followed and a week after the onset of the symptoms she passed, per rectum, a gall-stone about the size of a bean.

She then was up and around, was irregularly jaundiced, but never free from jaundice; had acholic stools at times; nausea and vomiting became constant after meals, with marked gas formation. She had irregular temperature, but no chill. Constant pain and tenderness in epigastrium with loss of weight. Gastric lavage gave slight relief for a time, but as the symptoms persisted and became gradually worse, she finally submitted to operation, for the removal of stone from the common duct.

Operation.—October 1, 1906, D. & R. G. R. R. Hospital, Salida, Colo. M. E. Connell of Chicago and G. E. Newell of Buena Vista, Colo., present. Ether administered by Dr. Harding; Dr. Johnson assistant. The Mayo Robson incision was made with the patient in the reversed Trendelenberg position.

There were numerous adhesions to gall-bladder, pylorus normal; gauze packs were inserted into the right kidney pouch and to the median line of the common duct. The gall-bladder was shrunken with thick walls, and of a dark yellowish color; no stones were palpable. The adhesions were broken up and the gall bladder and bile ducts exposed. The finger was inserted into the foramen of Winslow; the gastro-hepatic omentum was thickened and some enlarged and hardened glands were palpated, one of which was removed. The liver was rotated and in doing so the liver substance was torn.

In the second portion of the duodenum a mass about the size of a hickory nut could be palpated. This was located in the posterior wall of the duodenum, evidently a stone in the diverticulum of Vater. The stone could not be forced back into the supra-duodenal portion of the duct, nor on into the duodenum. An attempt to mobilize and rotate the second portion of the duodenum was made, in this way aiming to bring the posterior surface of the duodenum and the common duct into the field of operation; that is, to do a retro-duodenal choledochotomy. An incision was made through the parietal peritoneum about 1 inch to the right of the descending duodenum, but blunt dissection toward the median line was accompanied by so much hemorrhage, and was so difficult, that it was abandoned. Therefore, transduodenal choledochotomy was performed. With the stone and the overlying duodenal wall held between the thumb and forefinger of the left hand, the anterior wall of the duodenum was incised longitudinally in about the midline. This incision opened the lumen of the duodenum and exposed the posterior wall with the stone forming a prominence beneath the mucosa of the posterior wall.

The papillary orifice of the common duct was not distinguished. While the position of the left forefinger and thumb remained the same, a second incision was made directly over the stone through the posterior mucosa, exposing the stone (Fig. 4 A). Forceps were then inserted which grasped and removed the calculus, which was followed at once by the escape of bile. The common duct was explored, but no other stones were detected. The duodenal mucosa was not sutured. The incision in the anterior duodenal wall was securely closed with a single row of through and through sutures of Pagenstecker. The line of union was examined and cleansed with moist sponges. The tear in the liver was repaired with a mattress stitch of catgut. A typical cholecystostomy was next performed and the abdominal wound closed below the drainage tube. Convalescence was uninterrupted, and when last heard from, 9 months after operation, the patient was in perfect health.

In a review of the literature we find that Kocher,[34] in 1899, was able to collect 20 instances in which the common duct was opened through the duodenum.

In 1902 Thienhaus[33] added 9 to the list; and in January, 1906, Hancock[34] was able to collect 60 cases in which calculi were removed from the common duct in this manner.

I have been able to gather, with more or less detail, 77 instances in which this operation was carried out. Cases in which malignant disease was found are not included, nor are simple duodenotomies in which no stone was found in the duct, or in which the stone was found free in the lumen of the bowel. The cases are as follows: McBurney,[34] 11; Kocher,[10] 2; Robson,[30] 21; Moynihan,[35] 8; Kehr,[38] 5; Mayo,[12] 4; Sprengel,[36] 4; Ochsner,[13] 2; Ferguson,[33] 2; Robinson,[37] 2; Petersen,[38] 2; Czerny,[38] 1; Langenbuch,[38] 1; Terrier,[38] 1; Hoffmann,[38] 1; Pozzi,[16] 1; Haasler,[3] 1; Thienhaus,[33] 1; Dalziel,[39] 1; Tinker,[40] 1; Page,[41] 1; Hancock,[34] 1; Lagoutte,[42] 1; Sherk,[43] 1; Connell, 1. Total, 77.

In the 77 cases above cited there were 10 deaths: McBurney 2, 1 due to hemorrhage, 1 due to vomiting; Robson 5, 1 due to acute dilatation of stomach, 1 due to sub-diaphragmatic abscess, 1 due to pyæmia before operation, 1 due to duodenal fistula, 1 due to cause not mentioned; Moynihan 1, due to hemorrhage; Sprengel 1, due to duodenal fistula; Kehr 1, due to cholæmia and hemorrhage. Total, 10.

In all but the two cases in which duodenal fistula occurred the result could not be attributed to the method of the removal of the calculus.

The mortality rate is higher than that following simple supraduodenal choledochotomy, which is between 2 per cent. and 3 per cent. But the transduodenal operation is always a method of necessity and never of election. But it may be necessary during any operation on the gall-bladder or ducts.

In a farther analysis of these cases one finds that 12 cases occurred in males and 38 in females. As regards the ages: 4 were operated upon at ages between 25–30; 3 between 30–35; 10 between 35–40; 5 between 40–45; 10 between 45–50; 4 between 50–55; 8 between 55–60; 3 between 60–65; 2 between 65–70.

That stones in the common duct, especially its terminal portion, are frequently overlooked during operations upon the gall-bladder or upper parts of the duct is well shown by the fact that in 10 instances, mention is made of a previous operation on the bladder or ducts with or without removal of stones. In 31 cases single stones were removed from the ampulla; in 17 cases two or more stones were removed from the ducts. In 3 instances the calculi were pancreatic.

In 1 case the stone was the size of a pigeon's egg; 1 of a walnut; 1 of a hickory nut; 3 of a grape; 2 of a hazel nut; 4 of a cherry; 3 of a pea. In 7 cases, mention is made of futile attempts to mobilize the duodenum, for the purpose of performing retroduodenal choledochotomy.

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